

# PATENT ABSTRACTS OF JAPAN

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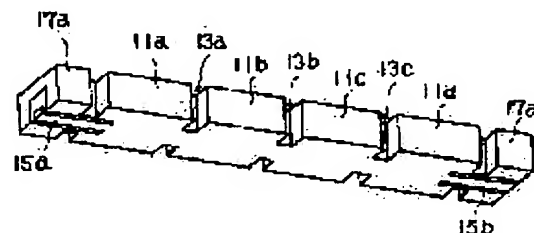
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## (54) DIELECTRIC WAVEGUIDE FILTER AND MOUNTING STRUCTURE THEREOF

(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a dielectric waveguide filter, which is capable of attaining its input/output matching and preventing an electromagnetical field from leaking out from the exposed part of its dielectric body, so as to reduce its lower loss.

**SOLUTION:** Rectangular parallelepiped dielectric bodies are linked together into a dielectric waveguide filter, composed of a plurality of dielectric waveguide resonators, and a dielectric protruding end is provided to each of the input/output end resonators. An input/output terminal conductor strip line is provided to each of the input/output end resonators so as to be equipped with an exposed dielectric part on both its side, extending from the input/output end resonator to the dielectric protruding end and terminated at the end face of the dielectric protruding end. The dielectric waveguide filter is coupled with the microstrip line or the coplanar line of a wiring board, which is formed longer than it is prescribed, so as to attain input/output impedance matching.



## LEGAL STATUS

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**CLAIMS**

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[Claim(s)]

[Claim 1] In the dielectric-waveguide filter which the dielectric-waveguide resonator of two or more rectangular parallelepipeds was connected, and equipped the dielectric-waveguide resonator of both ends with the I/O electrode The lobe of a dielectric is formed in the dielectric-waveguide resonator of both ends. From the dielectric-waveguide resonator base of both ends to the tip of the base of each lobe Elongation, It has an I/O electrode by the strip line. the conductor which equipped both sides with the outcrop of a dielectric -- each conductor -- the end face which touches the side which the strip line attains -- a conductor -- the part which touches the strip line -- a dielectric -- exposing -- \*\*\*\* -- a conductor -- the outcrop of the dielectric which touches the strip line -- removing -- other front faces of a dielectric -- a conductor -- the dielectric-waveguide filter characterized by being covered by the film.

[Claim 2] The dielectric-waveguide filter according to claim 1 by which an I/O electrode is connected with the microstrip line of a wiring substrate.

[Claim 3] The dielectric-waveguide filter according to claim 1 by which an I/O electrode is connected with the KOPURENA track of a wiring substrate.

[Claim 4] In the mounting structure of the dielectric-waveguide filter which the dielectric-waveguide resonator of two or more rectangular parallelepipeds was connected, and equipped the dielectric-waveguide resonator of both ends with the I/O electrode The lobe of a dielectric is formed in the dielectric-waveguide resonator of both ends. From the dielectric-waveguide resonator base of both ends to the tip of the base of each lobe Elongation, It has an I/O electrode by the strip line. the conductor which equipped both sides with the outcrop of a dielectric -- The dielectric is exposed in the part which touches the strip line. each conductor -- the end face which touches the side which the strip line attains -- a conductor -- It is covered by the film. a conductor -- the outcrop of the dielectric which touches the strip line -- removing -- other front faces of a dielectric -- a conductor -- Mounting structure of a dielectric-waveguide filter where the conductor pattern connected with an I/O electrode on the wiring substrate carrying the dielectric, respectively is arranged on a straight line, and spacing at the tip of those conductor patterns is characterized by being made shorter than spacing of the location of the opposite side of the end face of an I/O electrode.

[Claim 5] Mounting structure of a dielectric-waveguide filter according to claim 4 where the conductor pattern on a wiring substrate is a microstrip line.

[Claim 6] Mounting structure of a dielectric-waveguide filter according to claim 4 where the conductor pattern on a wiring substrate is a KOPURENA track.

[Claim 7] Mounting structure of a dielectric-waveguide filter according to claim 4 where the conductor pattern to which an I/O electrode is connected is a conductor pattern of one straight line formed on the wiring substrate.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001] This invention relates to a dielectric-waveguide filter and its mounting structure, and relates to the structure of the conductor pattern formed in the wiring substrate in which the I/O electrode and it are carried especially.

[0002]

[Description of the Prior Art] The dielectric-waveguide filter of various gestalten is obtained by combining two or more dielectric-waveguide resonators. However, with the old dielectric-waveguide filter, what formed the conductor pattern in the side attachment wall of a resonator, the thing which prepared the through tube in the resonator are considered as structure of an I/O electrode.

[0003] The structure of such an I/O electrode had the problem that discontinuity with the track on a wiring substrate will be large in a connection part, and the effect by the mismatching in the I/O section will become large. then, the application for patent 2000-329046 was shown in drawing 8 R> 8 and drawing 9 -- as -- a conductor -- the membranous tongue-shaped piece (strip line) 85 -- forming -- this -- the conductor on a wiring substrate -- it proposed making it combine with the strip line 86 and 86'.

[0004] however, the case where the tongue-shaped piece of such a conductor is used -- it -- up to an end face -- lengthening -- it is necessary to form -- a part of the end face -- a conductor -- the part which a dielectric exposes, without forming the film must be prepared. If the part which such a dielectric exposes exists, the electromagnetic field in a resonator will serve as leakage from the outcrop of this dielectric, this will serve as radiation loss, and it will become the factor which increases loss of a filter remarkably. Moreover, if a helicopter loading site is not controlled strictly, there is also a problem that a property will shift.

[0005]

[Problem(s) to be Solved by the Invention] When a dielectric-waveguide filter is mounted in a wiring substrate, this invention reduces the discontinuity of the signal line formed in the wiring substrate in the input/output terminal of a filter as much as possible, and offers the structure where the loss caused by reflection and radiation of the electromagnetic field in the I/O section can be reduced. Moreover, the mounting structure of a dielectric-waveguide filter with high productivity is offered with simple structure. Furthermore, the dielectric-waveguide filter from which a property does not change even if there is a location gap of some is offered.

[0006]

[Means for Solving the Problem] This invention solves the above-mentioned technical problem by improving the structure of the dielectric-waveguide resonator of an I/O edge, and adopting what suited the structure as a conductor pattern of the wiring substrate in which it is carried.

[0007] Namely, the dielectric-waveguide resonator of two or more rectangular parallelepipeds is connected, and it sets in the dielectric-waveguide filter which equipped the dielectric-waveguide resonator of both ends with the I/O electrode. The lobe of a dielectric is formed in the dielectric-waveguide resonator of both ends. From the dielectric-waveguide resonator base of both ends to the tip of the base of each lobe Elongation, It has an I/O electrode by the strip line. the conductor which equipped both sides with the outcrop of a dielectric -- each conductor -- the end face which touches the side which the strip line attains -- a conductor -- the part which touches the strip line -- a dielectric -- exposing -- \*\*\*\* -- a conductor -- the outcrop of the dielectric which touches the strip line -- removing -- other front faces of a dielectric -- a conductor -- it has the description to be covered by the film.

[0008] Furthermore, the conductor pattern connected with an I/O electrode on the wiring substrate in which the \*\*\*\*\* is carried, respectively is arranged on a straight line, and it has the description for spacing at the tip of those conductor patterns to have been made shorter than spacing of the location of the opposite

side of the end face of an I/O electrode.

[0009]

[Embodiment of the Invention] the lobe formed in two or more dielectric-waveguide resonators with which A. connection of the component of the dielectric-waveguide filter by this invention was done, and the resonator of B. I/O edge, and the conductor extended from the front face of the resonator of C. I/O edge to the end face of elongation and a lobe on the front face of a lobe -- the strip line -- it comes out.

[0010] the conductor of the width of face same to a wiring substrate as those strip lines -- a track will be formed, those strip lines will be connected and termination of these conductor patterns will be carried out on the base of a dielectric-waveguide resonator. The signal from a wiring substrate will combine with the resonance mode inside a dielectric-waveguide filter. the conductor of a wiring substrate -- a track can be formed so that it may be extended to the inside [ section / inside an I/O electrode / short ], and a property is not influenced even if the helicopter loading site of a dielectric-waveguide resonator shifts in the die-length direction of a track.

[0011] The \*\*\*\* cause of the I/O electrode is not directly carried out to the side attachment wall of a dielectric-waveguide resonator, but it is made to move to the location left to some extent by the lobe so that a dielectric may not be exposed in the side attachment wall of a part which connects the I/O electrode of a dielectric-waveguide resonator. You may make it lengthen the strip line of a conductor to the wall surface of a lobe.

[0012]

[Example] Hereafter, the example of this invention is explained with reference to a drawing. Drawing 1 is the perspective view showing the example of this invention. Four dielectric-waveguide resonators constituted with the dielectrics 11a, 11b, 11c, and 11d of a rectangular parallelepiped adjust to predetermined association by Slits 13a, 13b, and 13c. the conductor used as an input electrode -- the strip lines 15a and 15b are formed in the same base. In this example, the lobes 17a and 17b by the same dielectric are formed in the dielectrics [ of the rectangular parallelepiped which constitutes a resonator / 11a and 11d ] outside. the conductor used as an I/O electrode -- the strip lines 15a and 15b were formed ranging over Lobes 17a and 17b, respectively from the Dielectrics [ 11a and 11d ] base, and are extended to the edge of Lobes 17a and 17b.

[0013] the conductor of Lobes 17a and 17b -- the dielectric has exposed the part which touches the strip lines 15a and 15b. this -- a conductor -- it is for connecting the strip lines 15a and 15b to an I/O signal-line way. the conductor which drawing 2 showed the example of the configuration of the conductor pattern of the side attachment wall of the end face of a lobe, and was connected to ground potential -- the film 19 -- a conductor -- it is formed so that it may not connect with the strip line. a conductor -- even a side attachment wall may lengthen the strip line and conductor pattern 15' may be formed.

[0014] Drawing 3 is the perspective view showing other examples of this invention, and narrows width of face of the dielectric of Lobes 37a and 37b. Similarly, the example shown in drawing 4 shows what made width of face and height small in the dimension of the whole lobe. Of course, the conductor pattern of the side attachment wall of a lobe can be made into the configuration of arbitration as shown in drawing 2 .

[0015] Drawing 5 is the perspective view showing the mounting structure of carrying the dielectric-waveguide filter by this invention in a wiring substrate. The structure of a dielectric-waveguide filter is the same as the example shown in drawing 1 , and on the wiring substrate 18, the conductor patterns 19a and 19b located on a straight line are formed, and it is connected with the strip lines 15a and 15b of a dielectric-waveguide filter.

[0016] In the dielectric-waveguide filter by this invention, conductor patterns 19a and 19b are formed so that it may be further extended inside rather than the location of the edge inside the strip lines 15a and 15b. Even if the fitting location of a dielectric-waveguide resonator shifts a little in the die-length direction of a conductor pattern by this, effect is not produced in a property. In addition, as shown in drawing 6 , the conductor pattern of a wiring substrate may consist of only conductor patterns 29 of one straight line.

[0017] Actuation of the dielectric-waveguide filter by this invention is explained. the conductor used as the conductor pattern of the microstrip line formed in wiring substrates, such as a double printed board, or a KOPURENA track, and the I/O electrode of the dielectric-waveguide filter by this invention -- the strip line serves as a continuous configuration. Moreover, the interior of the I/O stage of a dielectric-waveguide filter is entered, and since termination is carried out, the I/O signal of the TEM mode flows on a base.

[0018] The field caused in the interior of a dielectric-waveguide resonator by this signal combines with the field of the basic resonance mode of a dielectric-waveguide resonator, consequently association of an external circuit and a resonator arises. With the joint structure by this invention, since the I/O electrode of a

filter is in the same flat surface as the signal line of a wiring substrate, the signal line of a wiring substrate and the continuity of the I/O electrode of a filter are maintained. By it, reflection of the RF signal produced by discontinuity can be suppressed.

[0019] Since the lobe which prepared the input/output terminal serves as cutoff waveguide to the basic-mode frequency of a dielectric-waveguide resonator since the dimension is small compared with the dielectric-waveguide resonator, and it stops revealing the electromagnetic field of resonance frequency outside, low loss is realizable.

[0020] The example which produced four samples as a dielectric-waveguide filter by this invention is explained. the conductor which constitutes the filter of the same structure as drawing 1 from a dielectric block which set 18.8mm and width of face to 4.1mm, and set height to 2.6mm for the whole die length, and serves as an I/O electrode -- it carried in the wiring substrate shown in drawing 6 , having set width of face of a strip to 0.68mm, and having used width of face of the outcrop of the dielectric of the both sides as 1.78mm. Consequently, as shown in drawing 7 , the ripple in a band was small with the 25GHz band, and it was checked that a damping property out of band can obtain a good filter shape.

[0021] The dielectric-waveguide filter by this invention had the I/O signal line and the high continuity, and the structure where termination of the signal line was carried out on the base of a resonator was used for it. By this, what kind of pattern may be used for the pattern of the wiring substrate (printed-circuit board) carrying a filter in the range in which the electric termination location of the electrode of the base of a filter does not change. For example, it is also possible to carry a filter on the strip line which continued as mentioned above, and corresponding becomes easy even when the dimension of a filter changes with modification of a specification.

[0022]

[Effect of the Invention] According to this invention At the time of loading to a wiring substrate, the discontinuity of the input/output terminal of a filter and the signal line of a wiring substrate can be abolished mostly, and the loss produced by reflection and radiation of the electromagnetic field in the I/O section can be suppressed to the minimum. Moreover, it becomes easy [ loading of a dielectric-waveguide resonator ]. Furthermore, since what is necessary is just to change the configuration of a dielectric, it is not necessary to add a special component and becomes advantageous in respect of a man day and cost.

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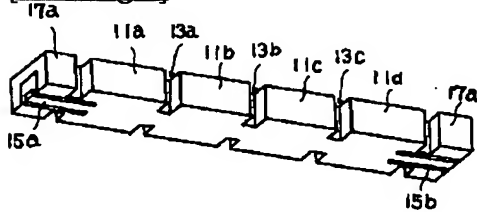
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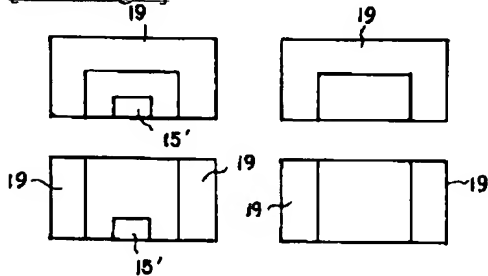
DRAWINGS

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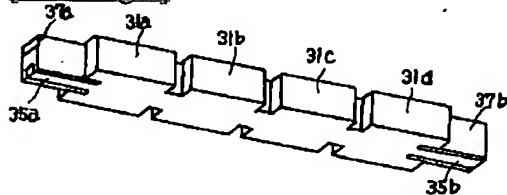
[Drawing 1]



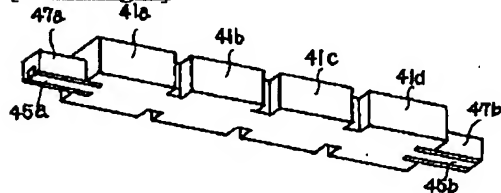
[Drawing 2]



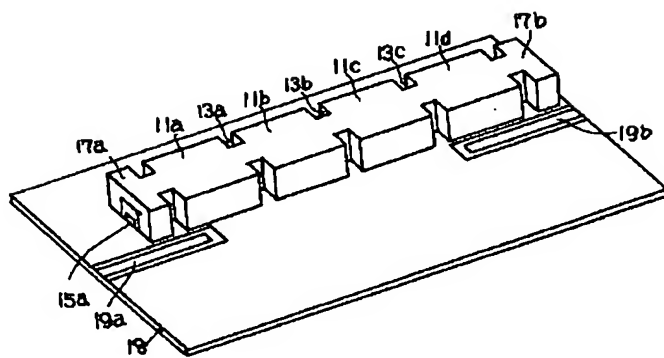
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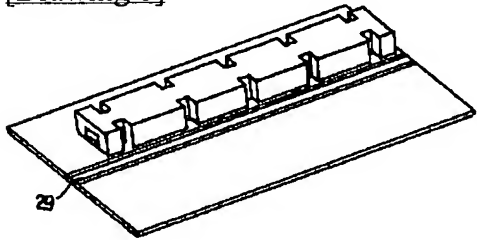
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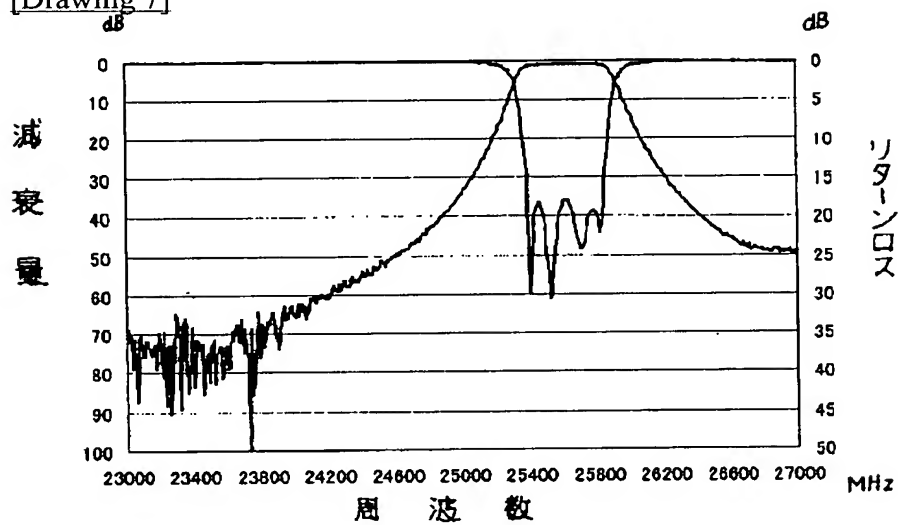
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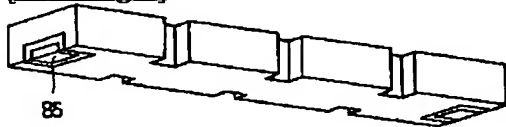
[Drawing 6]



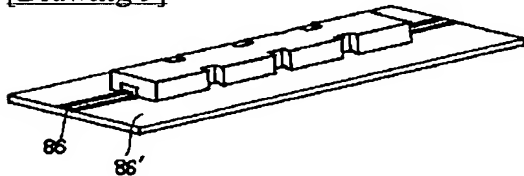
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]